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Credit risk management: A multicriteria approach to assess creditworthiness

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ABSTRACT

Credit risk management is a key issue for any company at anytime, but is especially important in the case of the banking industry. This fact is more than evident in times of financial crises, when financial institutions can suffer high losses due to unpaid credits. For this reason, international financial supervisors and authorities have forced banks to monitor their credit risk and this risk is a variable that is constantly under the scrutiny of all financial agents in the international markets.

There are currently several methodologies that aim to predict the default probability of debtors. Many of them use logit analysis to discriminate among debtors. New methodologies make use of neural networks or multicriteria methods. This paper presents a new proposal based on goal programming, which allows the judgement of experts to be incorporated into the model, as suggested by the Basel Committee. Our approach combines the objective information of financial variables with the subjective judgement of experts about the different relevance of these variables, so observing the Basel Committee guidelines.

1. Introduction

Financial institutions can face different types of risk [1]:

- Market risk: unexpected changes in prices or rates.
- Credit risk: unexpected changes in value associated with changes in credit quality.
- Liquidity risk: the risk that the costs of adjusting financial positions will increase substantially or that a company will lose access to financing.
- Operational risk: associated to human factors: fraud, system failures, trading errors.
- Systemic risk: chain reaction crises affecting the whole market.

In recent years, credit risk has been a focal point, mainly due to the international financial crisis that has considerably affected a large number of financial institutions [2]. Banks classify their corporate clients in terms of default probability, a variable that is essential for ranking clients when making decisions regarding financing. Default probability is usually obtained as a linear function from a set of economic and financial variables that provide information about different aspects of corporate clients: size, liquidity, solvency, profitability, debt, etc.

A scoring or ranking model combines these variables in order to obtain an accurate assessment of default probability, thus serving to automate the evaluation process of default risk measurement within a financial institution.

In order to obtain the aforementioned function, a set of explanatory variables x and a binary variable y corresponding with the company situation are related: y takes the value of 1 if the company has defaulted, and 0 otherwise.

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The problem can be summarized as finding a function (generally a linear one) that relates the dependent variable (default) with the set of explanatory variables (economic and financial information).

The most common statistical techniques for establishing the previous relation are logistic regression and discriminant analysis [3–8]. A compendium of the main research work that has made use of these techniques can be found in [9], where their restrictions are also analysed.

In both cases, a linear function is obtained estimating a company's probability of default from its financial information, but the initial assumptions for the application of each technique are different.

A common problem for logistic regression and discriminant analysis is that the sample needs to contain a relatively high number of companies in default situation so that the number of healthy and distressed companies is as balanced as possible. However, in the years preceding the current crisis, default companies made up a very reduced percentage as regards the total: less than 5% in all cases. Even in the case of the crisis getting much worse this percentage will in no case become comparable to that of healthy companies.

These problems greatly restrict the practical application of statistical techniques. Furthermore, by segmenting the sample of companies in two groups (solvent and insolvent companies) it is not possible to differentiate among the companies which belong to the same group. Therefore, although two companies may be currently solvent, that does not necessarily mean that their financial situation and solvency level are strictly equal. However, in the statistical models both shall be considered to be within the group of solvent companies, leaving aside their different degrees of solvency.

This paper's objective is to propose a model that, by means of a linear function, can relate the probability of default with the economic and financial information of the company (1) whilst going beyond the previously indicated restrictions for statistical techniques.

Unlike statistical approximations, in our proposal it will not be necessary to segment the sample into just two groups (healthy and distressed) but the degree of solvency/insolvency will be differentiated in a continuous manner.

For this, the intervention of an expert or group of experts is needed, so objective information (company accounting information) is combined with subjective information (the opinion of the expert or experts). In the Basel II Agreement, paragraph 91 deals with the eligibility criteria for the external credit assessment institutions (ECAI): "An ECAI should have sufficient resources to carry out high quality credit assessments. These resources should allow for substantial on going contact with senior and operational levels within the entities assessed in order to add value to the credit assessments. Such assessments should be based on methodologies combining qualitative and quantitative approaches". We believe that our proposal can be classified as a qualitative approach due to expert collaboration in eliciting the weights of financial information criteria, so not only quantifiable information, but also qualitative information from experts is employed.

The solvency function to be obtained will take the usual linear form of (1):

$$solv\,(x) = a_1x_1 + a_2x_2 + \cdots + a_mx_m = A^TX. \tag{1}$$

In this way, given companies p and q, company p is more solvent than q when $solv\,(p) > solv\,(q)$. That is, the probability of default for company q would be greater than the probability of default for company p. Therefore, the solvency function would allow us to create a global ranking of companies using their economic and financial information.

This paper's objective is not to know the absolute values obtained with function $solv$, but only the relative ones. What is relevant is the comparison that can be made between the companies using this function. This can be highly relevant when creating a rating of companies. Hence the range of values of function $solv$ turns out to be irrelevant and need not be restricted to that of a probability $[0 \ldots 1]$ which is the assumption of the statistical models.

The rest of the paper is structured as follows. In Section 2 the model is introduced. The proposed model is a goal programming model which obtains a company ranking according to its solvency level. In Section 3 a numerical example is shown with the aim of illustrating how the proposed model works. Finally, the paper concludes with a summary and conclusions, as well as a list of the references consulted.

2. Default elicitation based on ordinal rankings

The model suggested in this paper is empirical in nature. For this reason it moves away from statistical foundations of other classic approximations. It is mainly focused on a mathematical programming model, in which a simple hypothesis is assumed as mentioned further. Below, we introduce the different phases that make up the proposal and enable us to obtain the coefficients of function (1):

Step 1. Database selection.

In this first stage a set of n companies is selected from which function (1) will be deduced. One important requisite is that these companies must belong to the same sector, given that the relationship between accounting information and solvency can differ according to the sector analysed. It is difficult to compare a hotel with an agricultural firm. In order to determine the firm's sector we have employed the CNAE code. CNAE stands for Clasificación Nacional de Actividades Económicas, or National Classification of Economic Activities, and is devised by the Spanish Statistical Institute. In this classification we can find firms grouped in Agricultural firms (A code), Extractive firms (B code), Manufacturing firms (C code), and so on. In short, the most significant hypothesis of our proposal is that only firms belonging to the same sector must be considered. Also it is